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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

ORIGINAL

In the Matter of	)	
Amendment of Part 90 of the Commission's Rules to Adopt Regulations for Automatic Vehicle Monitoring Systems	)	PR Docket No. 93-61 RM-8013

To: The Commission

REPLY COMMENTS
OF
MOBILEVISION, L.P.

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July 29, 1993

SUMMARY

MobileVision, a wideband pulse-ranging LMS licensee, along with numerous other commenters in this proceeding, enthusiastically supports the Commission's proposal to adopt permanent rules to govern the licensing and operation of LMS systems and the valuable services they provide to the public. Under the interim rules adopted in 1974, enterprising companies such as MobileVision have developed technology, designed, tested and perfected systems, obtained licenses, and deployed or are deploying various types of advanced, innovative location services that benefit the public in a variety of ways. The interim rules have served well as a framework for such development. Much of the regulatory scheme, and particularly the flexibility, that has characterized the current rules should be maintained for the future. However, MobileVision's experience has shown that in some respects the interim rules require clarification or revision.

The parties filing comments in this proceeding fall essentially into three groups: wideband LMS interests, narrowband LMS interests, and parties who do not provide or intend to provide LMS services but who believe they may be affected by adoption of new regulations governing LMS. The latter group consists primarily of amateur radio licensees and users and manufacturers of Part 15 devices. The comments filed may seem, at first, to present the Commission with a variety of divergent spectrum allocation and licensing alternatives. However, MobileVision's ten years of experience in developing LMS systems and related

communications technology has taught it that there are fundamental and immutable laws of nature governing the provision of wideband pulse-ranging LMS, that those laws offer a clear and neutral framework within which to evaluate every proposed system and licensing scheme, and that no new or revolutionary approach has been or indeed can be devised but that it accommodate those basis natural laws.

Both MobileVision's system and its comments in response to the NPRM reflect its technical understanding of those laws and its long experience in effecting applications that are consistent with them. Other commenters who suggest that wideband and narrowband LMS systems can co-exist on the same frequencies, or that co-channel wideband systems can so exist, either do not understand these laws or, believing that their interests will be advanced thereby, have chosen to ignore them. MobileVision firmly believes that the Commission's initial review of LMS theory 20 years ago was sound and that the decision made at that time to allocate spectrum in 8 MHz bandwidths for wideband pulse-ranging systems was imminently proper. Full utilization of that bandwidth for the provision of LMS and ancillary communications services, MobileVision believes, is essential to the economic viability and technical integrity of wideband pulse-ranging systems.

As set forth in this Reply, MobileVision believes that the optimum licensing and allocation scheme for the 902-928 MHz band requires:

1. Wideband licensing that would protect current licensees to ensure the most rapid and fullest availability to the

public of these LMS services with provisions allowing for future licensees, as proposed alternatively in the NPRM, conditioned on such future licensees demonstrating protection to the initial licensee, to ensure availability of services on a clearly non-interfered basis;

2. Separation of narrowband and wideband LMS systems through adoption of the allocation scheme set forth in the NPRM with mandatory migration of narrowband systems within six months of the effective date of the Rule;

3. Continuation of current rules governing Part 15 devices and amateur radio services as secondary users of the spectrum, as proposed in the NPRM.

4. Licensing of the licensee's forward link in the same 8 MHz band as the licensee's wideband pulse-ranging services are provided, which placement would represent a change to the current licensing practice;

5. Expansion of the permissible end-users to include individuals and the federal government and to permit private carriage as set forth in the NPRM;

6. Expansion of the permissible uses to include LMS for all animate as well as inanimate objects, as proposed in the Notice; and

7. Adoption of the technical requirements proposed by the Commission, with the exception of its proposed measure of out of band emissions. MobileVision, particularly, supports the Commission's proposal not to restrict the permissible types of LMS

emissions in order to provide the greatest flexibility in the services provided.

MobileVision believes that the adoption of permanent

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years.[1] This framework has served the public interest. Operating within the flexible confines of those visionary rules and relying on them, MobileVision and other forward-looking, enterprising

grant current licensees a temporary period of geographical

manner proposed in the Notice, the regulatory structure established by the interim rules, with changes and revisions limited to those which experience has shown to be necessary in order to foster continued development and growth in this vital industry. In that regard, MobileVision is gravely concerned that a decision either to mandate the sharing of spectrum among wideband pulse-ranging LMS systems in the same area, or to subdivide the wideband spectrum into bandwidths of less than 8 MHz, will undermine investment, render virtually valueless the wideband pulse-ranging technology and systems developed to date, endanger the continuation of effort by entities such as MobileVision and thereby significantly delay, if not permanently forestall, the provision of many LMS services to the public, on a pervasive, low cost basis.

MobileVision recognizes that in several instances the comments present the Commission, not merely with the differing views of competitors who seek to have rules promulgated to their own economic advantage, but with directly opposing positions concerning fundamental technical matters. In evaluating the correctness of these contrasting positions, the Commission must consider the expertise, the demonstrated system experience, and market entry motivation of each commenter. The Commission must seek to promulgate those rules that permit the fullest readily available deployment of LMS on this spectrum. In doing so, the Commission should thus assure true competition among the various technologies that can serve the various segments of the marketplace desirous of using one or more LMS-related services --

wideband pulse-ranging, GPS, cellular, dead reckoning, or narrowband tag readers.

MobileVision believes the optimal balance of serving those interests would require:

1. Wideband licensing that would protect current licensees to ensure the most rapid and fullest availability to the public of these LMS services with provisions allowing for future licensees, as proposed alternatively in the NPRM, conditioned on such future licensees demonstrating protection to the initial licensee, to ensure availability of services on a clearly non-interfered basis;

2. Separation of narrowband and wideband LMS systems through adoption of the allocation scheme set forth in the NPRM with mandatory migration of narrowband systems within six months of the effective date of the Rule;

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5. Expansion of the permissible end-users to include individuals and the federal government and to permit private carriage as set forth in the NPRM;

6. Expansion of the permissible uses to include LMS for all animate as well as inanimate objects, as proposed in the Notice; and

7. Adoption of the technical requirements proposed by the Commission, with the exception of its proposed measure of out of band emissions. MobileVision, particularly, supports the Commission's proposal not to restrict the permissible types of LMS emissions in order to provide the greatest flexibility in the services provided.

The comments received by the Commission in this proceeding appear, upon first impression, to represent the views of a wide variety of interested parties. Upon examination, however, the commenters can be generally grouped into three segments: (1) licensees or potential licensees that provide or intend to provide LMS over wideband systems; (2) licensees or proposed licensees that provide or intend to provide LMS over narrowband systems; and (3) interested parties who do not provide or intend to provide LMS pursuant to licenses that are the subject of this proceeding but who believe they may be affected by adoption of the proposed rule.

The wideband commenters include three licensees and two non-licensees. The license holders are unanimous in their support of the Commission's proposal for wideband/narrowband separation. They are likewise unanimous in the view that wideband pulse-ranging systems require the full availability of an 8 MHz bandwidth, as provided in the interim rules. Finally they are unanimous in the view that wideband, pulse-ranging systems

operating in the 8 MHz bands must not be subjected to debilitating levels of harmful interference such as would result currently from the co-channel operation of multiple wideband pulse-ranging systems in the same geographical area.

The other two commenters do not appear to have functioning systems in the United States, nor licenses as yet. Their technical comments reflect, on one hand, a lack of experience and, on the other, a determined drive to achieve the competitive advantage by regulation that they were unwilling to compete for by investment in early efforts at LMS technological development. One of them, Pinpoint Communications, Inc. ("Pinpoint"), believes the entire band of 26 MHz should be open to any and all LMS licensee. It argues, contrary to field experience and the statements of the other wideband providers, that the band can be shared by all -- narrowband and wideband alike -- without interference.

The other non-licensee, Southwestern Bell Mobile Systems, Inc. ("Southwestern Bell" or "SBMS"), proposes that the two frequency bands currently allocated for wideband systems can be subdivided into smaller, yet exclusive, bands. The SBMS position is necessitated by the fact that the technology developed outside the United States that SBMS has licensed and proposes to use is apparently designed to use 4 MHz. Instead of redesigning their system to conform to the interim rules, SBMS wants the Commission to adopt rules that would require existing licensees, who complied with the interim rules, to redesign their systems. Such spectrum fragmentation is not consistent with the technical

comments provided by the other wideband parties. The SBMS position is also contrary to the public interest in making these important services available to the largest number of subscribers on the most efficient basis, since clear and undisputed technical evidence indicates that capacity decreases exponentially as the bandwidth is decreased, and on a competitive basis, since adoption of its proposal will preclude meaningful competition to the system SBMS intends to provide by combining LMS with its cellular business.

The narrowband LMS providers are inconsistent regarding the central issue affecting their use of the spectrum: whether LMS narrowband systems can co-exist on the same frequencies as wideband LMS systems. Certain commenters in the narrowband LMS segment who address this issue, principally the Amtech Group (but not all of it affiliates)[2] disagree with the proposal contained in the Notice to separate wideband and narrowband use in the spectrum. Their position rests upon the unsupported proposition, contrary to actual field experience, that such coexistence would not create debilitating interference. Other narrowband LMS providers who address this issue, such as Hughes, Texas Instruments, and Mark IV recognize that reality and support the necessity of the separation proposed by the Commission.

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[2] The Amtech Group includes Amtech and those entities which use Amtech equipment, such as the American Trucking Association, The Association of American Railroads, Harris County Toll Road Authority, the Greater New Orleans Expressway Commission ("Greater New Orleans"), Port Authority of New York and New Jersey and the Texas Turnpike Authority.

The third group of commenters involves amateur radio operators, manufacturers and users of Part 15 devices and others who believe that the Commission's proposal with respect to LMS in this proceeding will have an affect on their operations and business. These commenters generally lack any expertise with LMS systems. It is also difficult to gauge the level of their concern because in many instances their comments appear to be premised on the misunderstanding that the Commission has proposed the relocation of Part 15 devices and amateur radio services to spectrum outside the 902-928 MHz band. The Commission, as made clear in its Erratum, is not willing to consider such relocation.[3]

While, as noted at the outset, MobileVision supports most of the proposals in the Notice, it strongly objects to the proposal that spectrum should be shared by wideband systems through either channel coexistence or spectrum fragmentation. The only technical information based on experience with wideband pulse-ranging systems that has been presented in this proceeding establishes clearly that the resulting loss of capacity, accuracy, capability and quality from such sharing would render both wideband LMS systems technically and economically non-viable.

The two commenters supporting the notions of shared frequencies and spectrum fragmentation (licensing schemes that are, notably, directly antithetical to each other) do so because they are far behind in technological development and fear that

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[3] *In the Matter of Amendment of Part 90 of the Commission's Rules to Adopt Regulations for Automatic Vehicle Monitoring Systems*, Erratum, DA 93-516 (rel. May 5, 1993) ("Erratum").

they will continue to be competitively disadvantaged because of their own delayed entry in the market unless they can persuade the Commission to adopt rules that will wholly disrupt the regulatory environment that has been in place for almost 20 years and within which the only operative LMS technology deployed in this country has been developed. They seek to persuade the Commission to provide by regulation what they were unable or unwilling to earn by effort and investment. Their arguments, however, are flawed and their claims of serving the public interest are unpersuasive. Moreover, adoption of either of their proposals would require each of the other providers or proposed providers of wideband LMS service to fully redesign its system to meet their unique system design requirements. Neither of these commenters offers either credible evidence or creates a defensible record upon which the Commission could adopt a proposal for frequency sharing or spectrum fragmentation. Nor are there any other wideband supporters for such actions.

The Commission's alternative proposal for a temporary period of geographical separation for licensees operating on the same frequency bands,[4] combined with future entry opportunity for those able to clearly demonstrate sharing capability without interference, strikes an appropriate balance of interests. While current technology will not permit such a sharing and MobileVision believes the laws of nature make it very unlikely in the future,

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[4] The geographical separation which MobileVision supports is the 110 mile separation proposed by the Commission in the Notice.

the Commission's alternative proposal preserves future entry possibilities on an eminently fair and technically sound basis. At the same time, it provides that the public is not deprived of the expeditious availability of valuable services, that the industry pioneers are not deprived of the fruits of their toil, and accommodates any development that may permit services in the future on a viable shared basis.

II. WIDEBAND SYSTEMS REQUIRE 8 MHz OF UNSHARED SPECTRUM FOR TECHNICAL AND ECONOMIC VIABILITY

The comments of the current wideband system licensees are unanimous in objecting to the sharing of, or utilization of less than, 8 MHz of spectrum. The two commenters, SBMS and Pinpoint, who are now seeking licenses to provide wideband systems, however, propose methods of spectrum sharing -- spectrum fragmentation and time division coordination, respectively -- that are diametrically opposed and have markedly different, but equally deleterious, effects on system service. In the first case, the proposal reflects the motivation of SBMS to link limited LMS to its existing cellular service while precluding competition from the type of fully flexible and capable LMS system envisioned by the interim and proposed rules. In the second, the proposal indicates Pinpoint's level of inexperience and technical naivete further reflected in the description of its unworkable system. In both cases, the theoretical systems that would fit these aberrational licensing schemes would not be economically viable. While other comments were submitted to the Commission with regard to the

sharing of the two 8 MHz bands allocated to wideband systems, those submissions were made by those whose use of the spectrum is licensed on a non-interference basis, or by narrowband users whose interest in whether wideband systems can share on the same spectrum is tangential at best.[5]

A. Sharing of Spectrum by Wideband Systems will Create Debilitating Interference.

The MobileVision initial comments filed in this proceeding describe the technological means by which wideband pulse-ranging spread spectrum systems operate, the need for interference-free operation of such systems, and the sources and effects of interference, and included a Technical Appendix detailing the basis for the statements made in the initial comments. Those comments, as well as those filed by Teletrac (with accompanying expert affidavits), Location Services (the third licensee for wideband services) and Southwestern Bell are all unanimous in the position that the interference generated by two wideband systems operating on the same frequency in the same area would render the band useless within that area.

To reiterate the basic principles involved: a certain amount of interference can be tolerated by a wideband system consistent with its jamming margin, but above that interference

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[5] The interests of the Amtech Group are more than incidental, however, due to its view that all 26 MHz should be made available for its narrowband use and that all other systems should be capable of functioning in such an environment or be branded "fragile". Their only wideband ally in this demand is Pinpoint, whose system is the wideband system least capable of functioning in that environment.

tolerance, an emission by another source on the same frequency would cause the signal of the wideband system either to be lost or its time of arrival to be distorted. The result, in either case, is a loss of accuracy in the location function of the provided service. The wideband system commenters are unanimous - but for one - that techniques that permit shared spectrum for communication purposes, such as TDMA, are not suitable for location services.[6]

The only wideband commenter that urges the Commission to adopt frequency sharing and espouses the feasibility of TDMA sharing techniques to do so is Pinpoint.[7] Its comments in support of the notion that shared frequency is feasible are flawed in several respects: (1) the Pinpoint system, the capabilities of which are proposed as the example of a system that can share frequency and tolerate interference, is, in fact, the most fragile system of those proposed or used by LMS commenters and will not be able to function either in a shared environment as proposed or, for that matter, in the real world at all; (2) the TDMA methods proposed by Pinpoint for spectrum sharing are not suitable for any wideband LMS providers of location services; and (3) Pinpoint presents no legitimate justification for its proposal to rescind

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6 Teletrac provides the expert opinion of Dr. Raymond Pickholtz in this regard. See Engineering Analysis of Prof. Raymond Pickholtz, Appendix 1 to Teletrac Comments ("Pickholtz Statement"), pp. 27-33.

7 In spite of its terminology, Pinpoint does not suggest that total sharing, that is, fully simultaneous occupation of the same frequency in the same location by two or more systems, is possible.

valid existing licenses held by parties who have already developed and are deploying LMS systems. Rather, the sole purpose of that proposal is to permit Pinpoint, and others who have sought entry in LMS market only of late, a guaranteed entry opportunity to shared frequency that they failed to earn by timely effort and investment. In fact, the Pinpoint proposal will serve only to delay the further deployment of LMS systems that will provide valuable, needed and diverse services to the public.

1. Two Wideband LMS Systems Cannot Operate on the Same Bandwidth Due to the Resulting Interference: Pinpoint's is the Wideband System Least Able to Withstand Interference.

The initial comments of the wideband licensees in this proceeding have demonstrated that existence of two sets of pulse-ranging wideband signals will cause either the loss of those signals, or invalidate the time-of-arrival measurements of the signals, and, thus, frustrate the location ability of both systems.[8]

Attached hereto are several technical annexes, prepared by MobileVision engineers, analyzing and commenting on the technical parameters of different LMS systems and claims relevant to the comments filed in this proceeding. Technical Annex 4 specifically demonstrates that undesired co-channel signals from a second LMS system will exhaust the jamming margin of the initial wideband LMS system whenever the interfering signal is closer to

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[8] MobileVision Comments at pp. 33-34 and Technical Appendix at pp. 10-17; Location Services Comments at p. 4; Teletrac Comments at pp. 24-46; Pickholtz Statement at p. 12.

the receive site of the system than the near-far ratio of the system permits.[9] For example, if the near-far ratio is 2:1, reception of a signal will be blocked, or its time of arrival distorted, if the source of the signal is more than twice the distance to the intended receiver than an interfering signal source.

Technical Annex 1 examines the theoretical parameters of the Pinpoint system based on technical information supplied by Pinpoint in filings with the Commission. As that Technical Annex demonstrates, the Pinpoint system has significantly less jamming margin (interference tolerance) than the other wideband LMS systems on which data has been made available. The Pinpoint system will experience debilitating interference even when the source of the interfering signal is only slightly closer to the intended receive site than the source of the wanted signal.[10]

Pinpoint's technology is clearly the most fragile LMS system and probably incapable of withstanding the anticipated non-LMS sources of interference expected to be prevalent in the urban environment where LMS is expected to be offered. It does not represent, as Pinpoint would have the Commission believe, a technological breakthrough, but rather the ill-conceived result of design trade-offs between basic communications parameters for such systems that no experienced system designer would elect. (As

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9 Technical Annex 3 indicates the interference effects of narrowband systems on wideband systems.

10 Further, the range of the signal in the Pinpoint system is only 40% of the range of the MobileVision or a comparable

noted in Technical Annex 1, Pinpoint would be the first victim of disability due to interference if local area narrowband LMS providers are permitted on shared bandwidth with wideband providers.)

2. Pinpoint's Panacea for Spectrum Sharing, The Introduction of Time Division Techniques, is Not Practical Among Wideband Location Services.

To function properly, a wideband pulse-ranging system must be able to monitor thousands of vehicles in short time segments and update their locations at different intervals, depending on the service priority. Such systems must also include forward command links. Further, to be economically viable and serve demonstrated public interests, it must include the availability of high capacity communications services ancillary to the location services. In order to accomplish these diverse purposes, techniques based on both frequency and time division schemes are employed by the service provider in order to avoid self-generated interference. The use of time and frequency schemes in this manner within a single LMS system, therefore, is essential to effectively provide LMS services; to do so, it is also necessary to maintain contact on an uninterrupted basis with the vehicles and objects being monitored.

In its initial Comments, MobileVision described the limitations of TDMA as a tool for spectrum sharing among LMS system providers. It also described how the use of TDMA conflicted with the need for total control by the system provider. Pinpoint, nevertheless, urges the Commission to adopt an ambitious

proposal to require TDMA techniques among providers as a panacea for the debilitating interference that would result from the operation of two (or more) wideband providers on the same frequency band.[11] But Pinpoint's proposal to make sharing feasible through TDMA is unrealistic due to the lack of system control and fleet contact interruption that would occur.[12]

In addition, a system provider faces asynchronous demands from various subscribers to track and monitor vehicles in connection with safety, health and law enforcement needs. To permit needed location updates and accurate emergency response, where required, a system provider must receive pulse bursts in medical emergencies or stolen vehicle situations with much greater frequency than required for location updates for dispatch of commercial fleets. Current systems can allocate and control the timing and repetition of such updates for both synchronous and asynchronous situations.

Time sharing will critically restrict the flexibility of providers to adjust to these real life situations. In a hypothetical sharing by three wideband systems balancing the monitoring needs of thousands of vehicles (or objects), location

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11 If the implementation of TDMA for sharing was as simple as Pinpoint proposes and, of course, it is not, such sharing should be required in cellular, SMR, and other services where to date it has not been considered feasible by the Commission.

12 In the event of an LMS system shut down, it may take a significant amount of time to reestablish contact with all vehicles being monitored. The use of TDMA for sharing would have similar effects, that while not necessarily as severe, would cause unacceptable loss of reliability.

information will be updated less than one-third as often as when the band is not shared (accounting for guard time between "shares" and overhead functions whose duration is not reduced by sharing).